

H8-Z80-64K CPU / Memory / GIDE Card
Assembly, Configuration and Installation Guide

Board Revision 2.6
Gerber File Revision 32

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1 Disclaimer of Liability

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2 Introduction

The H8-Z80-64K V2.6 is a replacement board for the Heathkit H8 computer that replaces the CPU and memory boards for the Heathkit H8 personal computer. The board provides on-board ORG 0 functionality, and contains an optional GIDE interface. This documentation is for board revision 2.6 (Gerber file revision 32).

3 Technical Assistance

The best way to obtain technical assistance and ask questions is via the SEBHC Google group located here: <https://groups.google.com/forum/#!forum/sebhc>.

There are many experts that hang out in this group and willing to help.

The SEBHC main website is loaded with helpful documentation on vintage Heathkit computers. That site is here: <http://sebhc.lesbird.com/>.

Norberto Collado's website has many replacement cards for those who are restoring vintage Heathkit computers. This includes the H8-Z80-64K V2.6 board. Norberto's website is here: <http://koyado.com/>.

4 Ordering the Card

The H8-Z80-64K V2.6 card can be ordered from OurPCB. To order a board, email molly@ourpcb.com requesting a re-run of order 15122576. Specify the color of the solder mask (green, blue or red). You will be charged the re-order rate rather than full price.

To be worthwhile you will probably have to order a minimum of 5 boards. It is customary for members of the SEBHC group to post their intent to order and/or offer extra boards to the group at cost.

5 Board Views

Figure 4.1 on page 3 shows an X-Ray view of the board. It is a high resolution photo that can be zoomed for more detail. As assembly progresses, the component designators (e.g. U1) will gradually be covered. This view can serve as a handy reference for locating parts.

Figure 4.2 on page 4 shows a fully assembled boards with all options. This can help clarify any ambiguities related to the mechanical aspects of the assembly.

6 Getting Ready

6.1 Bill of Material (BOM)

§7 ([Assembly and Bill of Material \(BOM\)](#)) details the board assembly process. It contains a description and quantity for each part. If a part is optional, that is noted. The BOM is constructed by reducing the part count for any unused options. For example, §7.7 on page 19 calls for 10 2.2 μ f tantalum capacitors, but 4 are associated with the optional 12V and -12V regulators. (These are rarely used.) So, only 6 2.2 μ f Tantilum capacitors should be ordered when not using the optional 12V and -12V regulators.

In this way, the assembly list serves as a BOM, ordered by type and component. This helps searching sites for the desired components.

6.2 GALs

When the GIDE option is installed, the H8-Z80-64K V2.6 board requires two GALs. These should be programmed before assembling the board.

One GAL is a 16V8, which is installed at U301. The other is either 20V8 or 22V10. Either will work, but each has its unique “pds” programming file. All three “pds” files are attached to

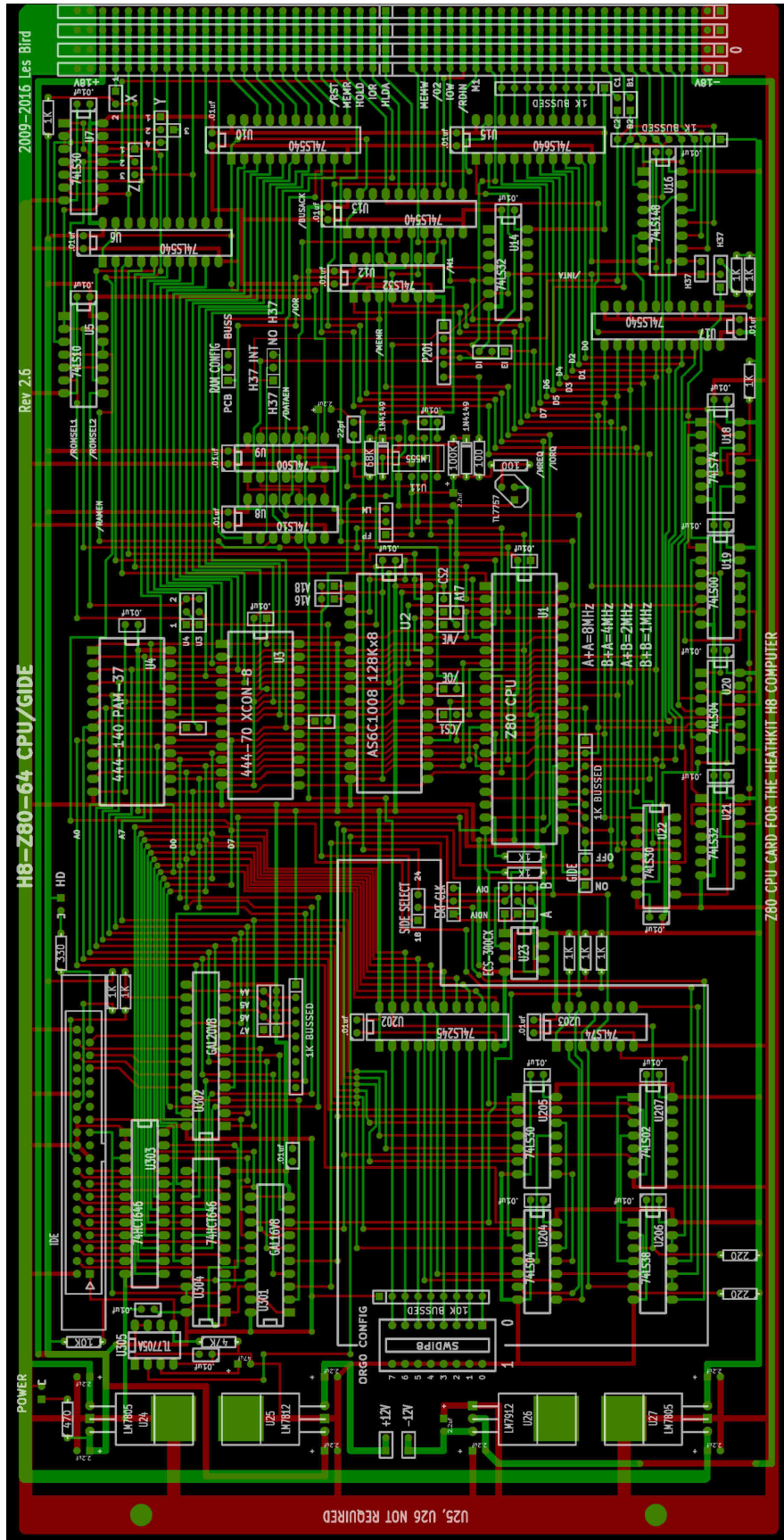


Figure 4.1: X-Ray View (Red=Bottom, Green=Top and White=Silk Screen)

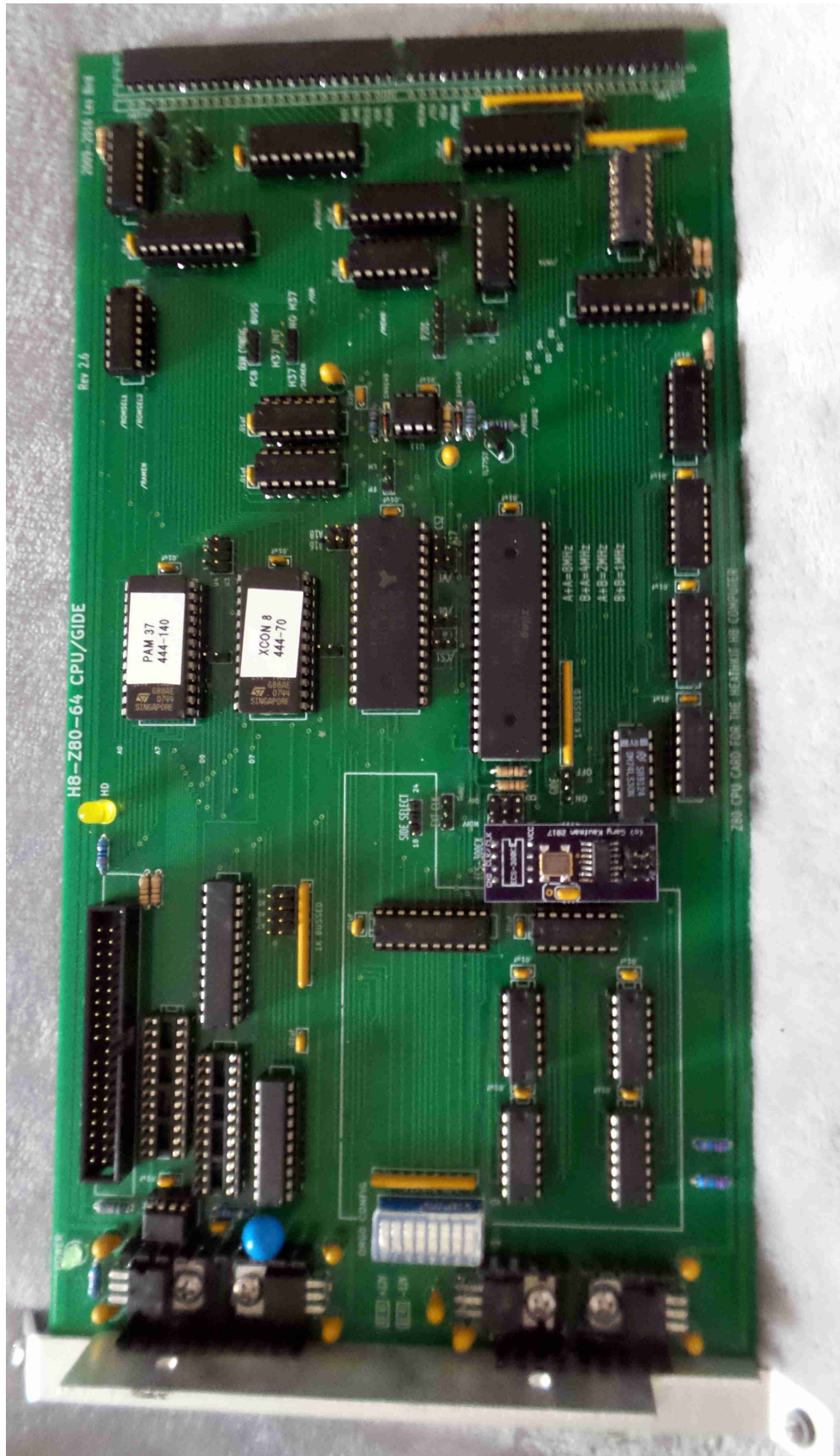


Figure 4.2: Fully Assembled Board

this PDF (while only two are used depending on whether a 20V8 or 22V10 GAL is used). See Appendix E ([Attachments](#)) on page 41.

6.3 EPROMs

The H8-Z80-64K V2.6 board uses two 2732 EPROMs. These should be programmed before assembling the board.

One should be a clone of Heathkit part number 444-40 (XCON-8). The other should be a clone of Heathkit part number 444-140 (PAM-37). All Heath/Zenith H8 monitor ROMs are available at the SEBHC website (<http://sebhc.lesbird.com/software/Roms/H8Roms.zip>). The XCON-8 and PAM-37 “hex” programming files are attached to this PDF. See Appendix E ([Attachments](#)) on page 41.

6.4 Identifying Resistor Values

Resistors are color coded. See Appendix A on page 32 ([Resistor Identification](#)) for the codes and an example.

The resistors on this board are metal film 5% axial mount resistors.

6.5 Polarized Components

Tantalum capacitors, electrolytic capacitors, LEDs and diodes are polarized devices. I.E., the “+” and “-” leads must be install correctly. Diodes have a black band that must align white line on the board. For the other devices the “+” lead is longer than the “-” lead. Often they are also marked with a “+”. Ensure these devices are installed with the correct polarity.

Appendix B ([Polarized Devices](#)) details identifying the polarity of these devices.

6.6 Mounting the Voltage Regulators

Voltage regulators are installed with a regulator, heat sink, screw, nut and thermal paste. The best screw is a 3/8” panhead M3 screw and corresponding nut. These are not included in the assembly section, but need to be ordered.

Figure 6.1 on page 6 shows how to position a regulator on its heatsink. Thermal compound is placed between the regulator and heatsink. Before placing the regulator and heatsink on the board, the three leads exiting the regulator must be bent down 90° where the leads narrow. The M3 screw is placed through the holes on the regulator, heatsink and board and affixed to the bottom of the

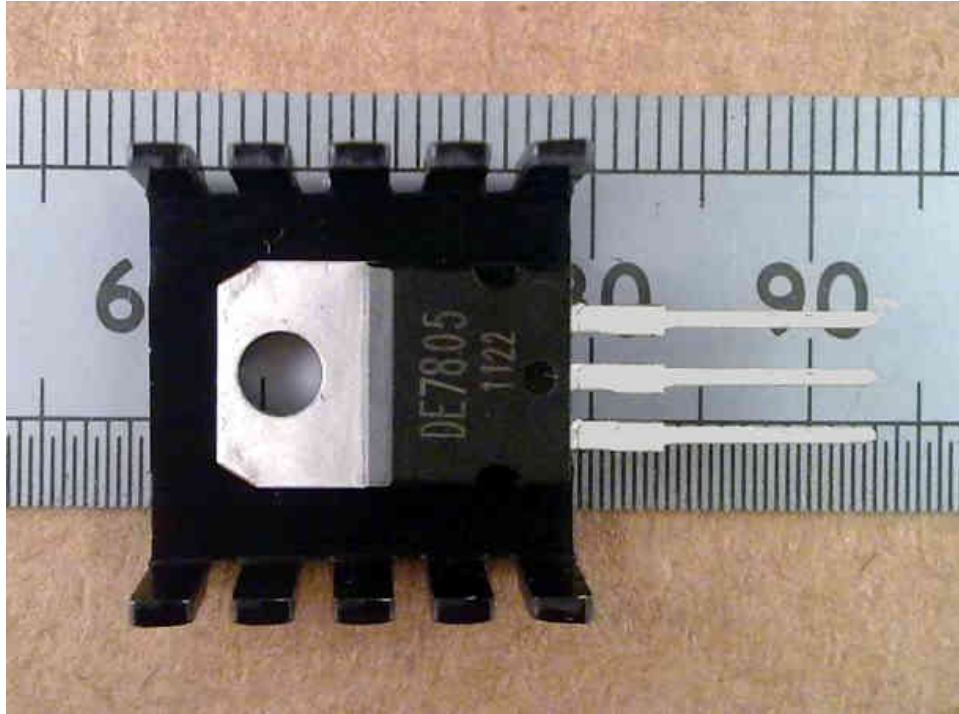


Figure 6.1: Placing a Regulator on its Heatsink

board using a nut. The three leads go through the hole on the board. (See Figure 4.2 on page 4) for a view of the final assembly.

If you install the 7912 -12V regulator, note that the heatsink may touch the Tantulum capacitor above the regulator. To avoid this, use a nibbling tool to remove the heatsink fin nearest the capacitor. See figure 4.2, on page 4 for details.

If you install the 7812 12V regulator notice the heatsink slightly overlaps area used by the $47\mu\text{f}$ electrolytic capacitor. The capacitor will fit, but must be installed after the heatsink is installed. Alternatively, a $47\mu\text{f}$ Tantulum capacitor will fit slightly better. Note either capacitor is polarized.



Figure 6.2: Pin 1 Shown in Red

6.7 About ICs

When placing ICs in their socket, orienting pin 1 correctly is important. There are three ways to do this. In order, they are:

1. Most ICs have a dot or circular indentation over pin 1.
 2. If a dot is not present, there is usually a notch. The notch is the top of the IC. Pin 1 is to the left of the notch. Beware, some ICs have two notches. Use the larger notch.
 3. If all else fails, you can use the text on the IC. Pin 1 will be the leftmost pin below the text.
- Refer to Figure 6.2 on page 6. Here, any of the three methods will work.

6.8 Handling Electrostatic Sensitive Devices

CMOS devices such as EPROMs, SRAMs and CPUs are electrostatic sensitive devices. A static charge buildup can damage these devices. (The 74LSxxx ICs are not electrostatic sensitive devices.)

Here are some tips for handling electrostatic sensitive devices:

- Limit your movement while handling these devices. Movement can cause static electricity to build up around you.
- Just before removing the device from its protective package, touch the package against the board. This will help dissipate any static charge.
- After touching the board, immediately remove the device and install it in its socket. This helps prevent building up a static charge.

6.9 H8 Mounting Bracket

The H8 mounting bracket is no longer available. However, the H8-Z80-64K V2.6 board replaces the existing CPU board and other memory boards in the system. The mounting bracket from one of those boards can be removed and used on the H8-Z80-64K V2.6 board.

6.10 Tools and Mechanical Considerations

Part mounted in holes on the board must be soldered into place. To avoid cold joints and solder bridges, a temperature controlled soldering station is highly recommended.

Figure 6.3 on page 8 shows tools frequently used in assembling boards:

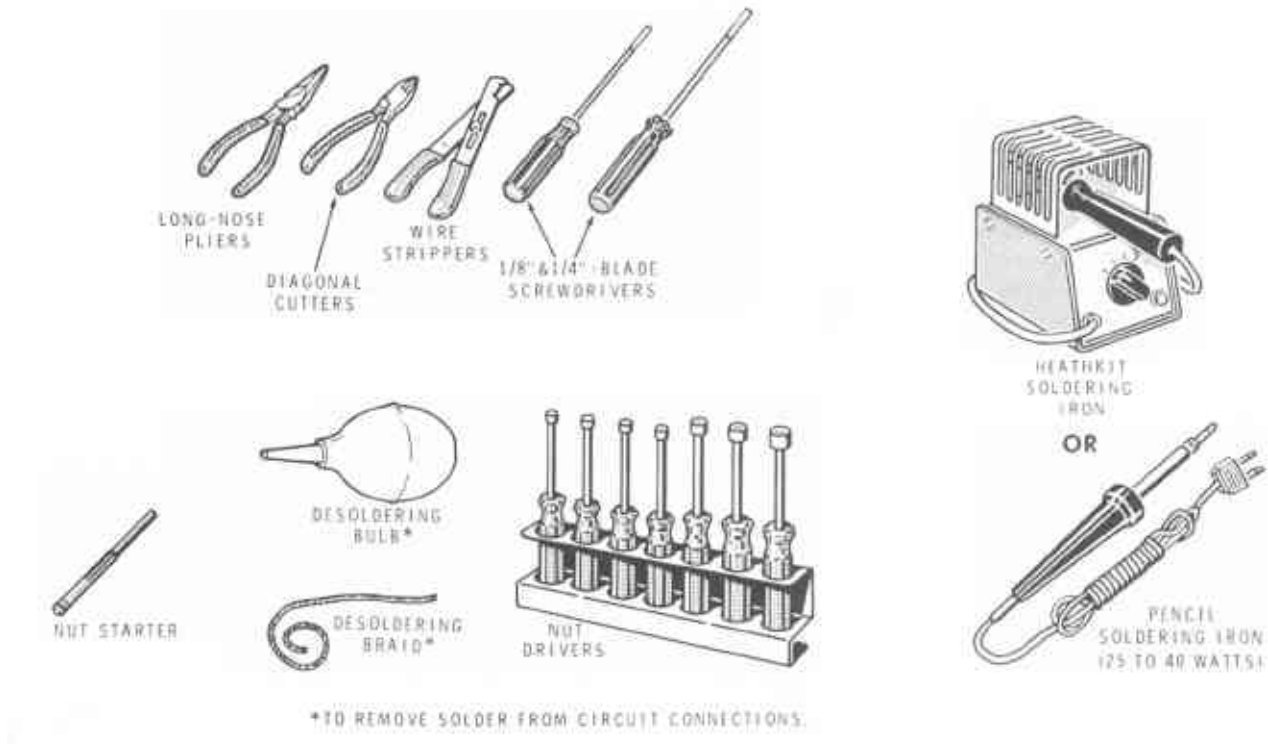


Figure 6.3: Tools

6.11 Soldering

Figure 6.4 on page 9 shows how to make a good solder connection. For best results, the soldering iron should touch both the component lead and board at a 45° angle so that both are properly heated and will accept the solder. If you notice a buildup of old solder and rosin, you should clean the soldering iron tip.

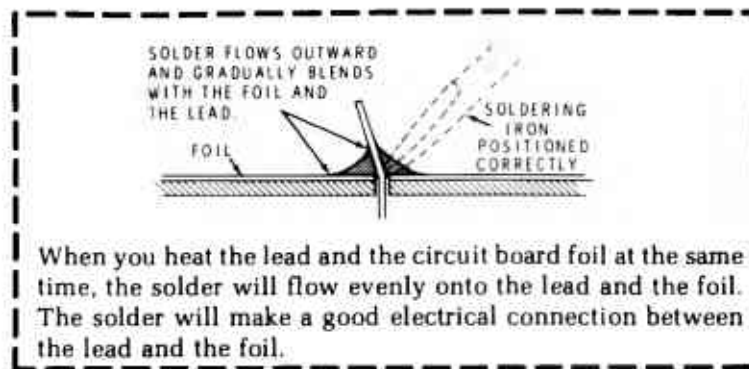
This is best done by brushing the tip on a wet sponge using a swiping motion.

Two common soldering problems are cold joints and bridges. A cold joint occurs when the lead and board are not heated evenly. Figure 6.4 shows the two ways this can happen – either the soldering iron is placed on the lead or board (but not both).

The other problem is a solder bridge. Figure 6.5 on page 10 shows this. (The H8-Z80-64K V2.6 has a solder mask that helps reduce the chance for a solder bridge.)

A solder bridge between two adjacent foils is shown in Figure 6.5(A). Figure 6.5(B) shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you “drag” the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is

A GOOD SOLDER CONNECTION



POOR SOLDER CONNECTIONS

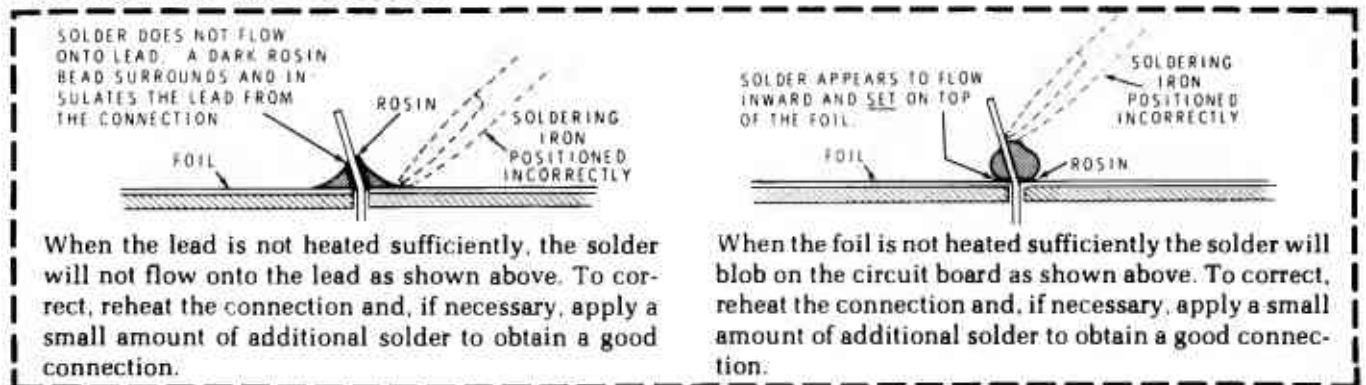


Figure 6.4: Soldering Hints

especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil. Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, reheat the bridge and use the desoldering braid or suction device to remove the solder.

6.12 Headers

The assembly instructions in §7 ([Assembly and Bill of Material \(BOM\)](#)) details each individual header. However, for ordering, it is more practical to cut the headers from 1xn and 2xn header strips. The headers can be consolidated and ordered as 1xn and 2xn header strips.

The holes on the board are a tight fit for the headers. The headers can be inserted by gently rocking the header into the holes while applying downward pressure. Because of the tight fit and to avoid mechanical interference from other parts, the headers are installed first.

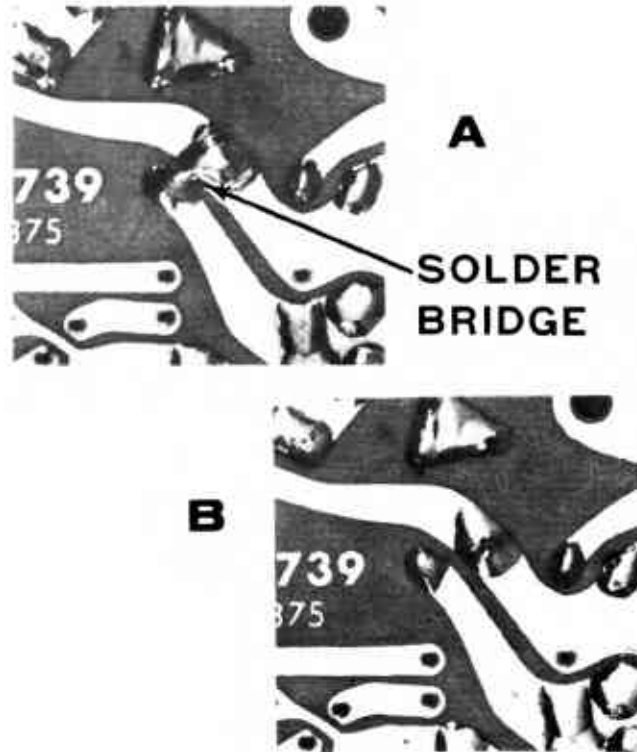


Figure 6.5: Solder Bridges

6.13 Clocking And Speed Considerations

If you plan on pushing the clock speed as fast as possible, consider ordering fast 2732 EPROMs, AS6C1008 SRAM, and Z80 CPU. 10MHz Z80 CPUs are readily available. There is no fixed formula to use, but the faster the component the faster the clock speed the board will likely support.

The ECS-300CX-163.8 oscillator at U11 is very difficult to find. There are several good alternatives:

6.13.1 Gary Kaufman's Daughter Board

This is the most flexible option. It is the best option if you plan to push the clock frequency on your system. It duplicates the ECS-300-CX functionality. However, you have to order and build a small PCB that installs directly in the ECS-300CX holes on the H8-Z80-64K V2.6 (no socket is used). You also have to be proficient enough with a soldering iron to mount SMD components.

Figure 6.7 on page 12 shows Gary Kaufman's ECS-300CX replacement board installed on a H8-Z80-64K V2.6. It is jumpered for divide by 8 output. (Divide by 2 and divide by 4 outputs are available.) Note the position of the jumper on the H8-Z80-64K V2.6.

The Gerber files and ordering info are available here: https://oshpark.com/shared_projects/sLL7Xix2.

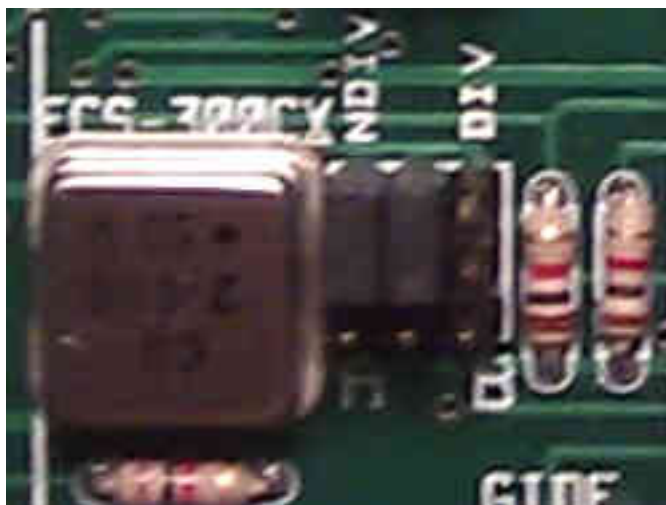


Figure 6.6: Half-Can 2.0MHz Oscillator Option for ECS-300CX

The oscillator is a CB3-3I-16M3840 (or 774-CB3-3I-16M3840) and is available from Mouser electronics [here](#). The SMD mounted 74LS93 is available from Mouser [here](#). The only other parts are the jumper pins, header socket and a $0.1\mu\text{f}$ capacitor readily available from Mouser, DigiKey, Jameco and other vendors.

6.13.2 Half-Can Oscillator

The ECS-300CX-163.8 extends the functionality and pin-out of standard half-can oscillators. Thus, it is possible to use a half-can oscillator in place of the ECS-300CX. Figure 6.6 on page 11 shows a half-can 2.0MHz oscillator (and jumper configuration) replacement for the ECS-300CX. The only frequency available is the frequency of the oscillator. So, it is less flexible than Gary's option but it simpler.

A 2.0MHz half-can oscillator is available from DigiKey [here](#).

If you plan on using only a single clock frequency, this is the best option.

6.13.3 Post a Question to the SEBHC Group

For other options that may be available at the time you build your board ask for advice at <https://groups.google.com/forum/#!forum/sebhc> (See §3 (Technical Assistance) on page 1.)

7 Assembly and Bill of Material (BOM)

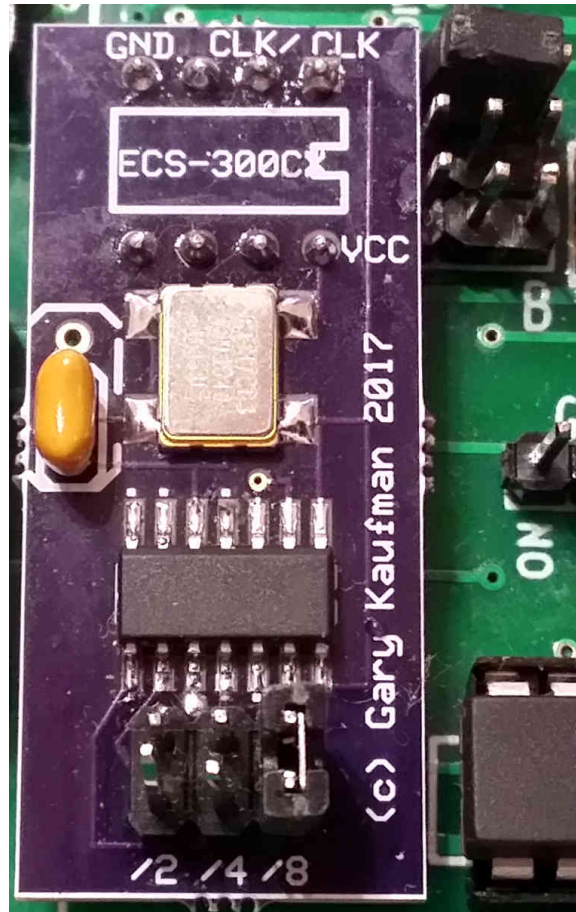


Figure 6.7: Gary Kaufman's ECS-300CX Replacement Board

If you have not read §6 (Getting Ready), at least follow the steps below in order.

This section documents the parts ordering and assembly process. Following the instructions in sequence helps minimize mechanical interference and assembly errors. Parts are grouped into part types (e.g., resistors, capacitors, etc.). These form the assembly sections below.

Within each assembly section, parts of that type are listed as bullet items. For each part, the number of parts required along with a full description of the part are included. Beneath each item, the locations

where that part is used are listed. Note that some parts are optional.

Installing all instances of a part at a time helps reduce assembly errors and eases pulling parts. The order of assembly helps reduce mechanical problems. As each component is installed, check it off.



Figure 7.1: Axial vs Radial Components

7.1 Axial vs Radial

Some components are available in either axial or radial packages. This terminology refers to how the leads exit the component. When the leads exit the component on either side through the center axis, the package is said to be *axial*. When the leads exit the component on one side, the package is said to be *radial*. For instance, a $47\mu\text{f}$ radial capacitor is mounted at step 7.13. If you were to order the axial version, it would not fit properly on the board.

Figure 7.1 on page 13 shows a $47\mu\text{f}$ 25V radial capacitor on top, and a $1\text{K}\Omega$ axial resistor on the bottom. (Both are used during the assembly process.)

7.2 Headers

(__) • Install 1 1x1 Straight Male Pin Header (0.025” square posts) at Y.

- Install 10 1x2 Straight Male Pin Header (0.025” square posts) as follows:

(__) 1. at X.

(__) 2. at Y.

(__) 3. below and to the right of U15.

(__) 4. below and to the right of U15.

(__) 5. below and to the left of U16.

(__) 6. below U4.

(__) 7. below U3.

(__) 8. below U2.

(__) 9. below U2.

(__) 10. below U2.

- Install 12 1x3 Straight Male Pin Header (0.025” square posts) as follows:

(__) 1. at Z.

(__) 2. below and to the right of U15.

(__) 3. to the right of U9.

(__) 4. to the right of U9.

(__) 5. to the left of U14.

- (__) 6. below and to the right of U4.
- (__) 7. below and to the right of U4.
- (__) 8. to the right of U2.
- (__) 9. below U2.
- (__) 10. below and to the left of U1.
- (__) 11. to the right of U202.
- (__) 12. to the right of U202.

- (__) • Install 1 1x5 Straight Male Pin Header (0.025" square posts) to the left of U12.

- (__) • Install 1 2x4 Straight Male Pin Header (0.025" square posts) below U302.

- (__) • Install 1 3x3 Straight Male Pin Header (0.025" square posts) to the right of U11.

7.3 Resistors

- (__) • Install 1 100 Ω (carbon/metal film, 5%, 1/4W, axial, 0.25") below U11.
- Install 2 220 Ω (carbon/metal film, 5%, 1/4W, axial, 0.25") as follows:
 - (__) 1. below U206.
 - (__) 2. below U206.

- (__) • Install 1 330Ω (carbon/metal film, 5%, 1/4W, axial, 0.25") to the right of the GIDE connector (used with GIDE option).
- (__) • Install 1 470Ω (carbon/metal film, 5%, 1/4W, axial, 0.25") above U24.
- Install 11 $1K\Omega$ (carbon/metal film, 5%, 1/4W, axial, 0.25") as follows:
 - (__) 1. above U7.
 - (__) 2. below and to the right of U17.
 - (__) 3. below and to the right of U17.
 - (__) 4. to the right of U18.
 - (__) 5. below U23.
 - (__) 6. below U23.
 - (__) 7. below U23.
 - (__) 8. to the right of U23.
 - (__) 9. to the right of U23.
 - (__) 10. to the lower right of the GIDE connector (used with GIDE option).
 - (__) 11. to the lower right of the GIDE connector (used with GIDE option).
- (__) • Install 1 $10K\Omega$ (carbon/metal film, 5%, 1/4W, axial, 0.25") to the left of the GIDE connector (used with GIDE option).
- (__) • Install 1 $47K\Omega$ (carbon/metal film, 5%, 1/4W, axial, 0.25") to

the left of U304 (used with GIDE option).

- (__) • Install 1 68K Ω (carbon/metal film, 5%, 1/4W, axial, 0.25”) above U11.
- (__) • Install 1 100K Ω (carbon/metal film, 5%, 1/4W, axial, 0.25”) below U111.
- Install 4 1K Ω bussed (SIP-9) as follows:
 - (__) 1. to the right of U15.
 - (__) 2. to the right of U16.
 - (__) 3. below U1.
 - (__) 4. below U302 (use when GIDE option installed).
- (__) • Install 1 10K Ω bussed (SIP-9) to the right of the DIP switch.

7.4 Diodes

- Install 2 1N4149 (DO-35) as follows:
 - (__) 1. above U11.
 - (__) 2. below U11.

7.5 LEDs

- (__) • Install 1 LED (radial, green, 0.1”) to the left of the GIDE connector.
- (__) • Install 1 LED (radial, yellow, 0.1”) to the right of the GIDE connector at HD (use when GIDE option installed).

7.6 Capacitors

(__) • Install 1 22pf (ceramic, radial, 0.1”) to the lower right of U9.

• Install 31 0.01 μ f (ceramic, radial, 0.1”) as follows:

(__) 1. to the right of U7.

(__) 2. above U10.

(__) 3. above U15.

(__) 4. above U6.

(__) 5. above U12.

(__) 6. above U13.

(__) 7. to the right of U14.

(__) 8. to the right of U16.

(__) 9. to the right of U5.

(__) 10. below U17.

(__) 11. above U8.

(__) 12. above U9.

(__) 13. to the right of U11.

(__) 14. to the right of U18.

(__) 15. to the right of U4.

(__) 16. to the right of U3.

(__) 17. to the right of U2.

(__) 18. to the right of U1.

(__) 19. to the right of U19.

(__) 20. to the right of U20.

- (__) 21. to the right of U21.
- (__) 22. to the right of U22.
- (__) 23. above U202.
- (__) 24. above U203.
- (__) 25. to the right of U204.
- (__) 26. to the right of U205.
- (__) 27. to the right of U206.
- (__) 28. to the right of U207.
- (__) 29. to the left of U303 (use when GIDE option installed).
- (__) 30. to the left of U304 (use when GIDE option installed).
- (__) 31. to the right of U301 (use when GIDE option installed).

7.7 Tantalum Capacitors

- Install 10 $2.2\mu\text{f}$ (tantalum, 25V, radial, 0.1") as follows:
 - (__) 1. to the right of U9.
 - (__) 2. to the left and below U11.
 - (__) 3. above U24.
 - (__) 4. above U24.
 - (__) 5. below U25 (use when 12V regulator installed).
 - (__) 6. below U25 (use when 12V regulator installed).
 - (__) 7. above U26 (use when -12V regulator installed).
 - (__) 8. above U26 (use when -12V regulator installed).
 - (__) 9. below U27.

(__) 10. below U27.

7.8 Sockets

- Install 2 8-Pin (DIP, 0.3”) as follows:

(__) 1. at U11 (Do not install if you use Gary Kaufman’s replacement board.) (See §6.13.).

(__) 2. at U305 (use when GIDE option installed).

- Install 13 14-Pin (DIP, 0.3”) as follows:

(__) 1. at U7.

(__) 2. at U12.

(__) 3. at U8.

(__) 4. at U9.

(__) 5. at U18.

(__) 6. at U19.

(__) 7. at U20.

(__) 8. at U21.

(__) 9. at U22.

(__) 10. at U204.

(__) 11. at U205.

(__) 12. at U206.

(__) 13. at U207.

(__) • Install 1 16-Pin (DIP, 0.3”) at U16.

- Install 6 20-Pin (DIP, 0.3”) as follows:

(__) 1. at U6.

(__) 2. at U10.

(__) 3. at U13.

(__) 4. at U15.

(__) 5. at U17.

(__) 6. at U301 (use when GIDE option installed).

- Install 2 24-Pin (DIP, 0.3”) as follows:

(__) 1. at U302 (use when GIDE option installed).

(__) 2. at U304 (use when GIDE option installed).

(__) ● Install 1 40-Pin (DIP, 0.6”) at U303 (use when GIDE option installed).

7.9 Intergrated Circuits

(__) ● Install 1 LM555 (Timer, DIP-8, 0.3”) at U11.

(__) ● Install 1 7705A (Single Supply Voltage Supervisor for 5V Systems, DIP-8, 0.3”) at U305.

(__) ● Install 1 7757 (Supply-Voltage Supervisor, TO-92) to the right of U1.

- Install 2 74LS00 (Quad 2-input NAND gates, DIP-14, 0.3”) as follows:

- (__) 1. at U9.
- (__) 2. at U19.
- (__) • Install 1 74LS02 (Quad 2-input NOR gates, DIP-14, 0.3”) at U207.
- Install 2 74LS04 (Hex inverters, DIP-14, 0.3”) as follows:
 - (__) 1. at U20.
 - (__) 2. at U204.
- Install 2 74LS10 (Triple 3-input NAND gates, DIP-14, 0.3”) as follows:
 - (__) 1. at U5.
 - (__) 2. at U8.
- Install 3 74LS30 (8-input NAND gate, DIP-14, 0.3”) as follows:
 - (__) 1. at U7.
 - (__) 2. at U22.
 - (__) 3. at U205.
- Install 3 74LS32 (Quad 2-input OR gates, DIP-14, 0.3”) as follows:
 - (__) 1. at U12.
 - (__) 2. at U14.
 - (__) 3. at U21.

- (__) • Install 1 74LS38 (Quad 2-input NAND buffer with open-collector outputs, DIP-14, 0.3”) at U206.
- Install 2 74LS74 (Dual positive-edge-triggered D flipflops, DIP-14, 0.3”) as follows:
 - (__) 1. at U18.
 - (__) 2. at U203.
- (__) • Install 1 74LS148 (8-line to 3-line priority encoder, DIP-16, 0.3”) at U16.
- (__) • Install 1 74LS245 (Octal Bus Transceiver, DIP-20, 0.3”) at U202.
- Install 4 74LS540 (Octal buffer/line driver with 3-state outputs, DIP-20, 0.3”) as follows:
 - (__) 1. at U6.
 - (__) 2. at U10.
 - (__) 3. at U13.
 - (__) 4. at U17.
- (__) • Install 1 74LS640 (Octal bus transceivers, DIP-20, 0.3”) at U15.
- Install 2 74HCT646 (Octal bus transceivers and registers with 3-state output, DIP-24, 0.3”) as follows:
 - (__) 1. at U303 (use when GIDE option installed).
 - (__) 2. at U304 (use when GIDE option installed).

- (__) • Install 1 GAL 20V8/22V10 (DIP-24, 0.3”) at U302 (use when GIDE option installed, see §6.2, page 2).
- (__) • Install 1 GAL 16V8 (DIP-20, 0.3”) at U301 (use when GIDE option installed, see §6.2, page 2).
- Install 2 2732 EPROM (DIP-24, DIP-32, 0.6”) (See §6.13.) as follows:
 - (__) 1. at U4 (program with PAM-37, 444-140, see §6.3, page 2).
 - (__) 2. at U3 (program with XCON-8, 444-70, see §6.3, page 2).
- (__) • Install 1 AS6C1008 (128Kx8 SRAM, DIP-32, 0.6”) (See §6.13.) at U2.
- (__) • Install 1 Z80A CPU (4MHz, DIP-40, 0.6”) (See §6.13.) at U1.
- (__) • Install 1 ECS-300CX-163.8 Dual Output CMOS Clock Oscillator, 16.384MHz (See §6.13.) at U23.

7.10 Switches

- (__) • Install 1 8 position DIP switch (DIP-16, 0.3”) at SWDIP8.

7.11 Voltage Regulators

- Install 2 7805 5V Voltage regulator (TO-220) (See §6.6, page 5.) as follows:

(__) 1. at U24.

(__) 2. at U27.

(__) • Install 1 7812 12V Voltage regulator (TO-220) (See §6.6, page 5.) at U25 (Used only if 12V power needed.).

(__) • Install 1 7912 -12V Voltage regulator (TO-220) (See §6.6, page 5.) at U26 (Used only if -12V power needed.).

7.12 Heatsinks

- Install 4 Heatsink (TO-220, compact, 0.5” width) (See §6.6, page 5.) as follows:

(__) 1. at U24.

(__) 2. at U27.

(__) 3. at U25 (Used only if 12V power needed.).

(__) 4. at U26 (Used only if -12V power needed. Fin may need to be removed.).

7.13 Electrolytic Capacitors

(__) • Install 1 47 μ f (electrolytic, 25V, radial, 0.1”) to the right of U25. (See §6.6, page 5 for mechanical considerations.).

7.14 Connectors

- Install 2 25 Position Receptacle Connector 0.100” right angle gold (Samtec BCS-125-L-S-HE, Digi-Key SAM1009-25-ND)

as follows:

(__) 1. along right side of board at top.

(__) 2. along right side of board at bottom.

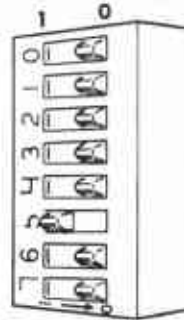
- (__) • Install 1 IDE connector, male, 2X20 Box Header Straight, 0.1” spacing, shrouded top left edge of board at IDE (use when GIDE option installed).

7.15 Brackets

- (__) • Install 1 H8 Mounting Bracket (See §6.9, page 7.) along left side of board.

8 Configuration

1. Install a jumper at X.
2. Install a jumper across 1-2 at Y.
3. Install a jumper across 1-2 at Z.
4. If an AS6C1008 is installed at U2, install jumper at PCB-center at RAM CONFIG. Otherwise install jumper at BUSS-center.
5. H37 Configuration: If an H37 soft sector controller is installed:
 - Install a jumper at H37-center at H37 INT.
 - Install a jumper at H37 (1x2 header beneath U16).



SWITCH	SETTING	DESCRIPTION
1,0	00*	Port 174(7CH)/177Q(7FH) has an H17 type disk (normal)
	01	Port 174/177Q has an H47 type disk
	10	Undefined
	11	Undefined
3,2	00**	Port 170(78H)/173Q(7BH) is not in use (normal without H47)
	01	Port 170/173Q has an H47 (normal with H47)
	10	Undefined
	11	Undefined
4	0	Boots from device at port 174/177Q (H17, normal)
	1	Boots from device at port 170/173Q (H47)
5	0	Performs memory test upon boot up (not currently supported)
	1	Does not perform memory test (normal)
6	0	Sets Console to 9600 baud (normal)
	1	Sets Console to 19,200 baud (not currently supported)
7	0	Normal boot (normal)
	1	Auto boot on power up or reset (not recommended)

NOTE: Press either the GO key or the 1 key on the Computer's front panel to boot from the drive indicated by the setting of switch section 4 (the primary boot device). Press the 2 key to boot from the device that is not selected by switch section 4 (the secondary boot device).

Figure 7.2: ORG 0 Extended Configuration Settings

- Install a jumper at H37 from left-center (1x3 header beneath U16).
- Remove 74LS148 from U16 and plug in interrupt ribbon cable from H37 board. (Ensure pin 1 is correctly positioned.)

If no H37 soft sector controller is installed:

- Install a jumper at center-NO H37 at H37 INT.
- Ensure no jumper at H37 (1x2 header beneath U16).
- Install a jumper at H37 from center-right (1x3 header beneath U16).
- Ensure 74LS148 is installed at U16 .

6. Install jumper below U4.
7. Install jumper below U3.
8. At 2x3 header below and to the right of U4, install a jumper between 1-center on U4 and a jumper between center-2 on U3.
9. If you are using the ECS-300CX-160 chip, following the configuration instructions on the silkscreen. If you are using an alternative, follow the instructions for that alternative.
10. Install jumper between 18-center on the Side Select configuration header.
11. Install jumpers at A4, A5, A6 beneath U302.

12. Refer to Figure 7.2 on page 27 to set the Extended Configuration 8-position DIP switch. Note the numbering on the switch may not match the numbering on the silkscreen. Always use the number on the silkscreen. Also, the mechanism for closing the switch varies with the switch. Always use the documentation on the switch to determine the on/off position.

9 Final Assembly

There is a gap between the edge connectors on the right side of the board. On Heathkit boards there is a solid nylon spacer. The spacer ensures the board is aligned properly when plugged into the backplane. Similar provisions should be made for this board. One easy solution is to glue a jumper header into gap using Gorilla glue.

The last step is a visual inspection of the board looking for:

- Unsoldered connections
- Cold solder joints
- Solder bridges
- The correct ICs are inserted into their sockets
- The ICs are oriented in their socket correctly and there are no bent pins
- Jumpers are installed correctly

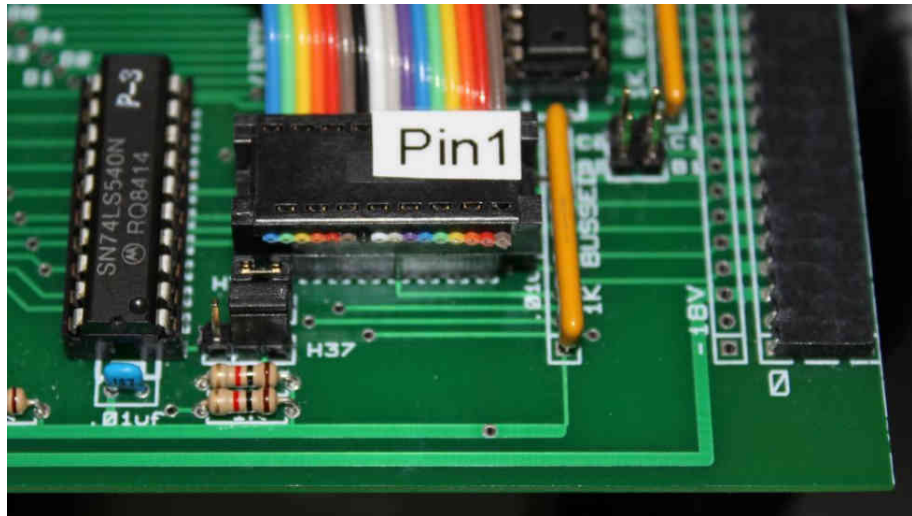


Figure 9.1: H37 Interrupt Ribbon Cable

10 Installation

- If the system contains an HA8-8 Extended Configuration Card (commonly known as an ORG 0 board), remove it.
- If you are using the H8-Z80-64K V2.6 for memory (AS6C1008 at U2 installed), remove all other memory boards from the system.
- On the existing CPU board, unplug the cable at P201. If you are using an H37, also remove the interrupt ribbon cable (see Figure 9.1 on page 30). Remove the old CPU board.
- Position the H8-Z80-64K V2.6 close to P2 on the backplane.
- If you are using an H37 card, plug the interrupt ribbon cable into U16. (Ensure pin 1 of the cable is correctly aligned, see Figure 9.1 on page 30.)

- Plug the cable into P201 on the H8-Z80-64K V2.6 board.
- Install the H8-Z80-64K V2.6 at P2 on the backplane. Ensure the edge connectors properly align with the backplane pins.

11 Acknowledgements

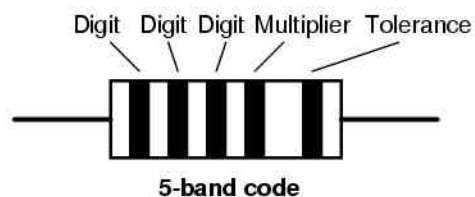
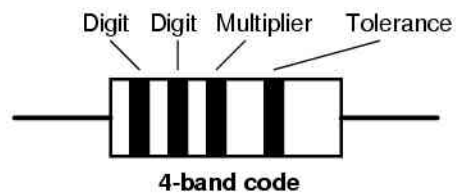
The author is grateful for the input and assistance of Norberto Colado, Gary Kaufman and Terry Terry Gulczynski.

Appendices

A Resistor Identification

Color		Digit	Multiplier	Tolerance %
Black		0	10^0	
Brown		1	10^1	1%
Red		2	10^2	2%
Orange		3	10^3	
Yellow		4	10^4	
Green		5	10^5	0.5%
Blue		6	10^6	0.25%
Violet		7	10^7	0.1%
Grey		8	10^8	
White		9	10^9	
Gold			10^{-1}	5%
Silver			10^{-2}	10%
(none)				20%

Table A.1: Resistor Color Codes



Example: The resistor below colored Orange-Orange-Black-Brown-Violet would be $3.3\text{ k}\Omega$ with a tolerance of $\pm 0.1\%$.



B Polarized Devices

A polarized device has positive (anode) and negative (cathode) leads. Polarized devices must be inserted into the holes that match the lead's polarity.

On the H8-Z80-64K V2.6 four polarized devices are used: diodes, LEDs, tantalum capacitors, and electrolytic capacitors.

B.1 Diodes



Figure B.1: Diode in a DO-35 Package

Figure B.1 on page 33 shows a diode in a DO-35 package. Notice the black band on the left side of the glass bead. This is the cathode (“-” lead). This should be aligned with the bar on the silkscreen.

B.2 LEDs

Figure B.2 on page 34 shows a LED. Notice one lead is longer than the other. The longer lead is the anode (“+”).

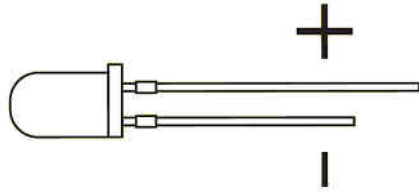


Figure B.2: LED

B.3 Tantalum Capacitors



Figure B.3: Tantalum Capacitor

Figure B.3 on page 34 shows a tantalum capacitor. Notice one lead is longer than the other. The longer lead is the anode (“+”).

B.4 Electrolytic Capacitors



Figure B.4: Electrolytic Capacitor

Figure B.4 on page 34 shows a radial electrolytic capacitor. Notice one lead is longer than the other. The longer lead is the anode (“+”).

C Connector Pinouts

C.1 P201 - Front Panel Connector

Pin	Dir	Description
1		GND
2	In	$\overline{\text{INT20}}$
3	Out	$\overline{\text{EI}}$
4	In	$\overline{\text{INT10}}$
5	In	RESET

C.2 H8 Backplane Connector

S201-		S201-	
24	GND*	49	+8V
23	MEMW	48	+8V
22	$\overline{\text{OE}}$	47	+18V
21	I/O $\overline{\text{W}}$	46	ROM DISABLE
20	RDYIN*	45	$\overline{\text{A}}_{15}$
19	$\overline{\text{M}}_1$	44	$\overline{\text{A}}_{14}$
18	GND*	43	$\overline{\text{A}}_{13}$
17	$\overline{\text{D}}_7$	42	$\overline{\text{A}}_{12}$
16	$\overline{\text{D}}_6$	41	$\overline{\text{A}}_{11}$
15	$\overline{\text{D}}_5$	40	$\overline{\text{A}}_{10}$
14	$\overline{\text{D}}_4$	39	$\overline{\text{A}}_9$
13	$\overline{\text{D}}_3$	38	$\overline{\text{A}}_8$
12	$\overline{\text{D}}_2$	37	$\overline{\text{A}}_7$
11	$\overline{\text{D}}_1$	36	$\overline{\text{A}}_6$
10	$\overline{\text{D}}_0$	35	$\overline{\text{A}}_5$
9	$\overline{\text{INT}}_2$ *	34	$\overline{\text{A}}_4$
8	$\overline{\text{INT}}_1$ *	33	$\overline{\text{A}}_3$
7	$\overline{\text{INT}}_7$	32	$\overline{\text{A}}_2$
6	$\overline{\text{INT}}_6$	31	$\overline{\text{A}}_1$
5	$\overline{\text{INT}}_5$	30	$\overline{\text{A}}_0$
4	$\overline{\text{INT}}_4$	29	RESET
3	$\overline{\text{INT}}_3$	28	MEMR
2	-18V	27	HOLD*
1	GND	26	I/OR
0	GND	25	HLDA*

*HEATH COMPANY RESERVES THE RIGHT TO CHANGE THESE PIN DESIGNATIONS.

D IC Pinouts

74LS00	Quad 2-input NAND gate	
74LS02	Quad 2-input NOR gate	
74LS04	Hex inverter	
74LS10	Triple 3-input NAND	
74LS30	8-input NAND	

74LS32	Quad 2-input OR	
74LS38	Quad 2-input NAND open collector outputs	
74LS74	Dual D-flop	
74LS148	8-line to 3-line priority encoder	
74LS245	Octal Bus Transceiver	

74LS540	Octal buffer/line driver with 3-state outputs	
74LS640	Octal bus transceivers	
74HCT646	Octal bus transceivers	
2732	32Kx8 EEPROM	
AS6C1008	128KBx8 SRAM	

16V8	GAL	
20V8	GAL	
22V10	GAL	
Z80	CPU	

E Attachments

The following files are attached. Most PDF viewers allow saving an attached file by clicking on its pin icon:

- ➡ **444-70-XCON-8.hex**: Programming file for XCON-8.
- ➡ **444-70-XCON-8-Checksum.txt**: Checksum for XCON-8
- ➡ **444-140-PAM-37.hex**: Programming file for PAM-37
- ➡ **444-140-PAM-37-Checksum.txt**: Checksum for PAM-37
- ➡ **GIDE-GAL-16V8.pds**: Programming file for GAL-16V8¹.
- ➡ **GIDE-GAL-20V8.pds**: Programming file for GAL-20V8¹.
- ➡ **GIDE-GAL-22V10.pds**: Programming file for GAL-22V10¹.

¹Two GALs are required when installing the GIDE option. One is a 16V8. For the other, choose between either a 20V8 or 22V10 – either will work equally well, but use different programming files. When programming a GAL, ensure you use the pds file designed for that GAL.